

W-T-1553B
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SUPERSEDING
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FEDERAL SPECIFICATION

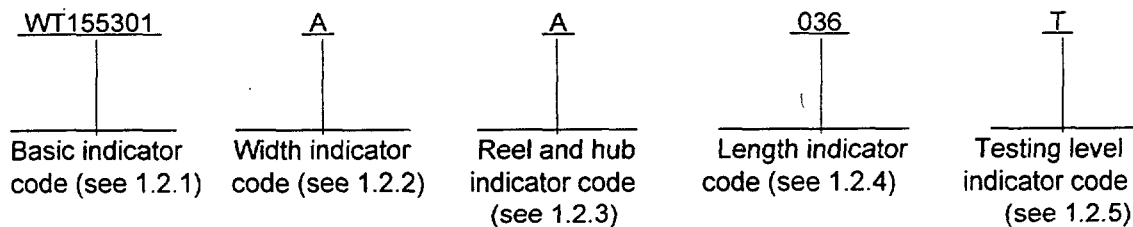
TAPE, INSTRUMENTATION, RECORDING, MAGNETIC OXIDE-COATED, GENERAL SPECIFICATION FOR

The General Services Administration has authorized the use of this federal specification, by all federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers longitudinally oriented magnetic particle recording tape, wound on reels and hubs conforming to specification W-R-175, for use on instrumentation recording equipment.

1.2 Classification. Tapes furnished under this specification shall be designated in the following form, as specified (see 6.2):



1.2.1 Basic indicator code. The basic indicator, letters "WT155301" (WT1553 plus a slash sheet designator of 01 through 04) denotes the tape specified in this document.

1.2.2 Width indicator code. The width indicator code is a one-digit alpha code that designates the width of the base material (see table I).

Beneficial comments, recommendations, additions, deletions, clarifications, etc., and any data which may improve this document should be sent to: Defense Supply Center, Columbus, ATTN: DSCC-VAM, Post Office Box 3990, Columbus, OH 43216-5000, or telephone (614) 692-0548, or facsimile (FAX) (614) 692-6939.

AMSC N/A

FSC 5835

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

TABLE I. Width indicator code.

Width indicator code	Nominal width
A	1/2-inch
B	1-inch

1.2.3 Reel or hub indicator code. The reel and hub indicator code is a one digit alpha code which corresponds to the reel and hub indicator code of W-R-175 (see table II).

TABLE II. Reel or hub indicator code.

Reel and hub indicator code	Code which conforms to W-R-175.	Reel and hub indicator code	Code which conforms to W-R-175.
A	PCP	F	PGP
B	QCP	G	QGP
C	SCP	H	SGP
D	TCP	J	TGP
E	UCP	K	UGP

1.2.4 Length indicator code. The length indicator code is the nominal length, in feet, of a tape wound on a hub, see table III.

TABLE III. Length indicator code.

Length indicator code	Minimum length (feet)
036	3,600
046	4,600
072	7,200
092	9,200
108	10,800
125	12,500

1.2.5 Testing level indicator code. The testing level indicator code denotes the type of quality conformance inspection (QCI) testing of this instrumentation tape.

- Blank = Standard QPL level of tape with QCI performed by the manufacturer.
 T = Standard QPL level of tape with QCI performed by the DoD Magnetic Media Laboratory located at the Naval Air Warfare Center in Warminster, PA.

2. APPLICABLE DOCUMENTS

2.1 Government publications. The following documents, of the issues in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specifications

- L-P-378 - Plastic Sheet and Strip, Thin Gauge, Polyolefin.
- W-R-175 - Reels and Hubs for Magnetic Recording Tape, General Specification for.
- W-R-175/2 - Reel, Hubs, Fiberglass and Metallic, with 3-Inch Center Hole.
- W-R-175/3 - Reels, Plastic, Fiberglass, Metallic, and Metallic Flange Phenolic Hub, with 3-Inch Center Hole.
- W-R-175/4 - Reels, Precision, Aluminum, with 3-Inch Center Hole.
- W-R-175/6 - Reels, Precision, Glass Flange with Aluminum Hub, 3-Inch Center Hole.
- W-T-1553/01 - Tape, Instrumentation Recording, Magnetic Oxide-Coated, 345 Oersteds Coercivity, 5 Dropouts Per 100 Foot (30 Meters) of Tape, With 76.2 Millimeter (3 Inch) Center-Hole Diameter Reel.
- W-T-1553/02 - Tape, Instrumentation Recording, Magnetic Oxide-Coated, 345 Oersteds Coercivity, 4 Dropouts Per 100 Foot (30 Meters) of Tape, With 76.2 Millimeter (3 Inch) Center-Hole Diameter Reel.
- W-T-1553/03 - Tape, Instrumentation Recording, Magnetic Oxide-Coated, 700 Oersteds Coercivity, 4 Dropouts Per 100 Foot (30 Meters) of Tape, With 76.2 Millimeter (3 Inch) Center-Hole Diameter Reel.
- W-T-1553/04 - Tape, Instrumentation Recording, Magnetic Oxide-Coated, 800 Oersteds Coercivity, 2 Dropouts Per 100 Foot (30 Meters) of Tape, With 76.2 Millimeter (3 Inch) Center-Hole Diameter Reel.

W-T-1553B

Federal Standards

FED-STD-209 - Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones.

(Activities outside the Federal Government may obtain copies of federal specifications, standards, and commercial item descriptions as specified in the General Information section of the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index is for sale on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Single copies of this specification, and other federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration, Federal Supply Service Bureau, Specification Section, Suite 8100, 470 L'Enfant Plaza, SW, Washington, DC, 20407.)

(Federal Government activities may obtain copies of federal standardization documents and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

Military Specification

MIL-I-631 - Insulation, Electrical, Synthetic Resin Composition, Nonrigid.

(Copies of military specifications and standards required by contractors in connection with specific procurement functions are obtained from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

Federal Regulation

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA), LABOR Code of Federal Regulations (CFR) CFR 29, Part 1910 (OSHA 2206) - Hazardous Communications

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the federal agency responsible for issuance thereof.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Inter-range Instrumentation Group (IRIG)

IRIG 106 - Telemetry Standards (AD/A089 908).

IRIG 118 - Test Methods for Telemetry System and Subsystems Vol. III (AD/A121 858).

(Application for copies should be addressed to the Defense Logistics Agency, Defense Documentation Center, Cameron Station, Alexandria, VA 22314.)

American Society for Testing and Materials (ASTM):

- D 257 - Standard Test Methods for D-C Resistance or Conductance of Insulating Materials. (DoD adopted).
- D 638 - Standard Test Method for Tensile Properties of Plastics. (DoD adopted).

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19013.)

National Institute of Standards and Technology.

- RP1879 - Bureau of Standards Research Paper, Volume 40, May 1948.

(Application for copies should be addressed to the National Institute of Standards and Technology, Gaithersburg, MD 20899.)

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets.

3.2 Qualification. The tapes furnished under this specification shall be products which are qualified for listing on the applicable qualified products list (QPL). (See 4.3 and 6.3).

3.3 Materials. Tapes furnished under this specification shall be new, consist of a layer of magnetic particle material on a base material, and a layer of back coating material on the opposite side and shall have all the characteristics specified herein.

3.3.1 Flammable material. Material which continues to burn when tested in accordance with 4.6.1 shall not be used.

3.3.2 Fungus resistance. The tape shall not support fungus growth when tested in accordance with 4.6.2. As an option to testing to 4.6.2, the contractor shall certify that the tapes meet the requirements of fungus inert materials.

3.4 Wind. Unless otherwise specified (see 6.2), tape shall be a continuous wind on reels and hubs conforming to W-R-175 as specified, with the oxide surface toward the hub (see 4.5.1).

3.5 Length and width. As specified (see 6.2), tape shall be of the length and width required in table IV and table V, respectively (see 4.5.5). Excessive tape tension shall not be used to accommodate the length requirement for the minimum radial distance (see 3.5.1).

TABLE IV. Tape lengths.

Reel diameter inches (in.) (centimeters (cm))	Hub diameter in. (cm)	Length indicator	Actual minimum tape length feet (meters)
10.5 (27)	4.5 (11.4)	036	3,625 (1,104.9)
10.5 (27)	4.5 (11.4)	046	4,625 (1,409.7)
12.5 (32)	4.5 (11.4)	072	7,230 (2,203.7)
14.0 (36)	4.5 (11.4)	072	7,230 (2,203.7)
14.0 (36)	4.5 (11.4)	092	9,235 (2,814.8)
15.0 (38)	4.5 (11.4)	108	10,835 (3,302.5)
16.0 (41)	4.5 (11.4)	125	12,540 (3,822.2)

TABLE V. Tape width.

Width indicator	Nominal width dimensions in. (mm)	Actual width dimension in. (mm)	Width tolerance in. (mm)
A	0.500 (12.7)	0.498 (12.65)	±0.001 (.0254)
B	1.000 (25.4)	0.998 (25.35)	±0.001 (.0254)

3.5.1 Radial distance. The radial distance by which the reel flanges extend beyond the outermost layer of tape, when the tape is wound at a tension of 8 ounces (224 g) (±2 ounces (56 grams)) per one-half inch (12.7 mm) of tape width. The minimum value for all tape lengths shall be not less than 0.125 inch (3.175 mm) (see 4.5.6).

3.6 Physical characteristics. The physical characteristics of the tape shall be as shown in table VI.

TABLE VI. Physical characteristics.

Characteristics	Width indicator A 0.500 inch (12.7 mm)	Width indicator B 1.000 inch (25.4 mm)
Yield strength (pounds force, minimum)	6.4	12.6
Shock strength (foot-pounds, minimum)	1.16	2.0
Elongation under stress (percent, maximum)	0.5	0.27
Modulus of flexibility (degrees of angle, minimum)	45	45

3.6.1 Yield strength. The 1 percent offset yield point, the force at 3 percent elongation, and the breaking force of the tape shall equal or exceed the value specified in table VI (see 4.6.3).

3.6.2 Shock strength. The minimum energy absorption (shock strength) of the tape shall be not less than the value specified in table VI (see 4.6.4).

3.6.3 Elongation under stress. The elongation of the tape shall not exceed the value specified in table VI (see 4.6.5).

3.6.4 Modulus of flexibility. The modulus of flexibility (the ability of the tape to form a minimum radius of curvature when a specified amount of tape is permitted to extend beyond a horizontal surface acting normal to the tape surface) shall be as specified in table VI (see 4.6.8).

3.6.5 Layer-to-layer adhesion. The tape shall show no sticking or layer-to-layer adhesion (blocking) (see 4.6.6).

3.6.6 Longitudinal curvature. The longitudinal curvature of each tape edge shall not deviate from a straight line by more than 0.125 inch (3.175 mm) (see 4.6.7).

3.6.7 Wound pile envelope. The tape shall be smoothly wound to form an integral mass, and shall not be loose either axially or circumferentially. There shall be no visible folds, buckling, cinching, spoking, or gaps between the tape layers. The edges of the wound tape shall be in a single plane with a minimum of protruding tape edges, layers, or groups of layers. A pack wheel may be used; however, it shall not force the tape wind into a cosmetically acceptable envelope. The tape shall be wound in a manner that the tape edges are not physically damaged or touching the reel flanges (see 4.5.2).

3.6.8 Anchorage. The magnetic oxide layer, and the conductive back coating layer of the tape shall show no visible evidence of anchorage failure after completion of tests (see 4.5 and 4.6). Commonly used recorder solvents or cleaners (isopropyl alcohol) shall have no effect on coating layers and base material during repeated passes on a reference recorder-reproducer (see 4.6.10.1). Anchorage failure is a separation of the oxide or back coating from the base material, or internal failure shedding of the coating layer (see 4.5.3).

3.6.9 Splices. Tape lengths shall be continuous and splice-free (see 4.5.4).

3.6.10 Slitting. The slitting process shall provide a clean sheared surface, free of jagged edges, cracked coating, and shedding of base material (see 4.5.7).

3.6.11 Frictional vibration. As the tape passes over the guides and heads in its normal path, a frictional vibration can occur, resulting in an audible squeal, or an amplitude and/or frequency modulation of the recorded signal. The tape shall not exhibit any of these characteristics when run at any of the speeds as specified in IRIG 106. Any lubricant utilized to combat this potential problem shall not cause harmful effects to recorder-reproducer transport, heads, or tape performance (see 4.6.9).

3.7 Magnetic characteristics. The tape shall have the magnetic characteristics specified in 3.7.1 through 3.7.15 as applicable.

3.7.1 Sensitivity. When tested as specified in 4.6.10.8, the output signal level at any point in a reel of tape shall not vary from the standard output level of the centerline or reference tape of the same type by more than 0 decibels (dB) ± 2.0 dB.

3.7.2 Wavelength response (WT 155301, WT 155302 and WT 155303). When tested as specified in 4.6.10.9, the output signal level at any point in a reel of tape and at all of the specified test frequencies (see 3.1) shall not vary from the standard output level of the centerline or reference tape, when properly normalized, by more than the values as specified (see 3.1).

3.7.3 Saturated output (WT 155304). When tested as specified in 4.6.10.10, the saturated output signal level at any point in a reel of tape and at all of the specified test wavelengths (see 3.1) shall not vary from the standard saturated output level of the centerline or reference tape, when properly normalized by more than the values as specified (see 3.1).

3.7.4 Output level uniformity (short term). When tested at the specified frequency for the tape as specified in 4.6.10.11, the short term uniformity of a signal output at any point in a reel shall be such that the maximum signal variation in output as a percentage (dB ratio) of maximum peak output signal does not exceed the values specified (see 3.1).

3.7.5 Output level uniformity (long term). When tested at the specified frequency for the type tape as specified in 4.6.10.12, the long term uniformity of the signal output at any point in a reel shall be such that the variation from maximum peak output to minimum peak output, as expressed in dB, does not exceed the values specified (see 3.1).

3.7.6 Instantaneous nonuniformity (dropouts). When tested as specified in 4.6.10.13, the instantaneous nonuniformity or dropout shall be as specified (see 3.1).

3.7.7 Harmonic distortion. When tested as specified in 4.6.10.14, the third harmonic distortion of a recorded signal on a tape shall not exceed 2 percent.

3.7.8 Signal-to-noise ratio. When tested as specified in 4.6.10.15, the signal-to-noise ratio of a recorded signal on tape shall be not less than the signal-to-noise ratio of the centerline or reference tape by more than 4 dB.

3.7.9 Layer-to-layer signal transfer (print-through). When tested as specified in 4.6.10.16, a signal resulting from the effects of being magnetically transferred to an adjacent portion of tape shall be not greater than -40 dB.

3.7.10 Ease of erasure. When tested as specified in 4.6.10.17, the process of effect of an erase field to remove a signal recorded on the tape shall be a minimum of 60 dB.

3.7.11 Electrical resistance. When tested as specified in 4.6.10.18, the electrical resistance of the conductive back coating surface shall not exceed the resistance values specified (see 3.1). The back coating shall be durable, nonshedding, and electrically conductive. The manufacturer may use an alternative test method with approval of the qualifying activity. In case of dispute, the method in 4.6.10.18 is the referee.

3.7.12 Abrasivity. When tested as specified in 4.6.10.19, the abrasivity of the magnetic surface of a tape shall not cause an increase in signal level output greater than 2.5 dB. The manufacturer may use as an alternative test method, an alfesil bar with approval of the qualifying activity.

3.7.13 Durability. When tested as specified in 4.6.10.20, the wear characteristics of the tape shall not exceed the dropout criteria as specified (see 3.1).

3.7.14 Bi-directional performance. When tested as specified in 4.6.10.21, the tape shall meet the wavelength, sensitivity, and output level uniformity (short term and long term) parameters specified (see 3.1).

3.7.15 Environmental extremes. When tested as specified in 4.6.10.22, the tape shall meet the output level uniformity (short term and long term) values as specified (3.1).

3.8 Workmanship. The base material, magnetic oxide, surface, and conductive back coating shall be free from any raised areas, dust, flakes, powder, holes, foreign matter, scratches, creases, or other defects that render the tape unsuitable for its intended use. The packaging material shall be free of dust, flakes, powder, holes, foreign matter, or other defects that render the tape unsuitable for its intended use.

4. QUALITY ASSURANCE PROVISIONS

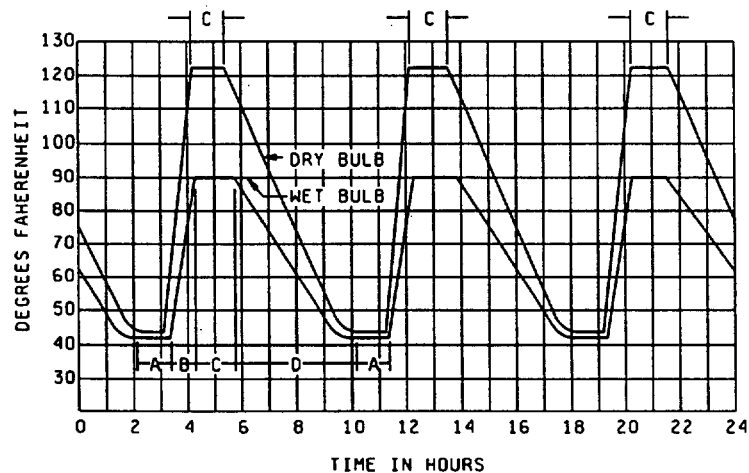
4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Classification of examinations and tests. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.2.1 Test conditions. Test conditions shall be as follows:

- a. Preliminary conditioning of each roll of tape shall be performed as specified on figure 1. After preliminary testing, the tape shall be held in a room conditioned at $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($23.8^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$) and 50 percent ± 5 percent relative humidity (RH) for 24 hours.
- b. Unless otherwise specified, testing and inspection shall be conducted in a class 1000 clean room in accordance with FED-STD-209. The temperature shall be maintained at $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($23.8^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$) and the RH shall be maintained at 50 ± 5 percent.



NOTES:

1. A: One hour, dry bulb temperature $43^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($6^{\circ}\text{C} \pm 1^{\circ}\text{C}$) and 85 percent to 89 percent RH.
2. B: One hour, transition from "A" to "C". The dry bulb temperature increases linearly. The RH decreases such that at no time shall the dew point be reached.
3. C: One and one-half hours, dry bulb temperature $122^{\circ}\text{F} \pm 4^{\circ}\text{F}$ ($50^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and 26 percent to 30 percent RH.
4. D: Four and one-half hours, transition from "C" to "A". The dry bulb temperature decreases continuously at a rate not exceeding 59°F (15°C) per hour at any time. The RH shall increase at such a rate that the dew point is never reached.

FIGURE 1. Conditioning temperature and humidity.

4.3 Qualification inspection. Qualification inspection (see table VII) shall be performed at a laboratory acceptable to the Government (see 6.3) on sample tape produced with equipment and procedures normally used in production. Qualification of a particular tape type shall be the basis for qualification of all tapes of that identical tape type regardless of length (see 3.1).

4.3.1 Sample size. Tapes subjected to qualification shall be as specified in the applicable specification sheet (see 3.1). The sample size shall be six of each PIN specified.

4.3.2 Inspection routine. Qualification samples shall be subjected to the tests as specified in table VII. Two samples of each PIN shall be subjected to each test group of table VII.

4.3.3 Failures. No failures shall be allowed. Failures shall be cause for refusal to grant qualification approval. The manufacturer may with the approval of the qualifying activity, submit a proposal to pursue an additional qualification effort.

4.3.4 Disposition of sample units. The reels of tape subject to qualification inspection shall not be delivered on a contract or purchase order.

4.3.5 Retention of qualification. To retain qualification the contractor shall provide verification to the qualifying activity of the following items every 12 months:

- a. Design of the tape has not changed.
- b. Verification that the conformance inspections (i.e., table VIII inspections) have performed on inspection lots supplied to the requirements of this specification.
- c. The contractor retains the capability to manufacturer and test tapes to this specification.

TABLE VII. Qualification.

Test group	Examinations and tests	Applicable requirement	Applicable test	Sample size
A	Wind	3.4	4.5.1	2 of each PIN specified
	Length and width	3.5	4.5.5	
	Radial distance	3.5.1	4.5.6	
	Wound pile envelope	3.6.7	4.5.2	
	Anchorage	3.6.8	4.5.3	
	Splices	3.6.9	4.5.4	
	Slitting	3.6.10	4.5.7	
	Workmanship	3.7	4.5	
	Output level uniformity (Short term)	3.7.4	4.6.10.11	
	(Long term)	3.7.5	4.6.10.12	
	Instantaneous nonuniformity	3.7.6	4.6.10.13	
B	Longitudinal curvature	3.6.6	4.6.7	2 of each PIN specified
	Frictional vibration	3.6.11	4.6.9	
	Sensitivity	3.7.1	4.6.10.8	
	Wavelength response ^{1/}	3.7.2	4.6.10.9	
	Electrical resistance ^{2/}	3.7.11	4.6.10.18	
	Harmonic distortion	3.7.7	4.6.10.14	
	Signal-to-noise ratio	3.7.8	4.6.10.15	
C	Flammable material	3.3.1	4.6.1	2 of each PIN specified
	Fungus resistance	3.3.2	4.6.2	
	Yield strength	3.6.1	4.6.3	
	Shock strength	3.6.2	4.6.4	
	Elongation under stress	3.6.3	4.6.5	
	Modulus of flexibility	3.6.4	4.6.8	
	Layer-to-layer adhesion	3.6.5	4.6.6	
	Layer-to-layer signal transfer	3.7.9	4.6.10.16	
	Ease of erasure	3.7.10	4.6.10.17	
	Abrasivity	3.7.12	4.6.10.19	
	Durability (destructive)	3.7.13	4.6.10.20	
	Bi-directional performance	3.7.14	4.6.10.21	
	Environmental extremes	3.7.15	4.6.10.22	

^{1/} Saturated output for WT155304, applicable requirement 3.7.3, applicable test 4.6.10.10.

^{2/} The electrical resistance test shall be performed both before and after durability test.

4.4 Quality conformance inspection (QCI).

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of inspections in table VIII.

TABLE VIII. Quality conformance inspection.

Examinations and tests	Applicable requirement	Applicable test	Sample size
Wind	3.4	4.5.1	See table IX for sample size
Length and width	3.5	4.5.5	
Radial distance	3.5.1	4.5.6	
Wound pile envelope	3.6.7	4.5.2	
Anchorage	3.6.8	4.5.3	
Splices	3.6.9	4.5.4	
Slitting	3.6.10	4.5.7	
Workmanship	3.7	4.5	
Output level uniformity (Short term)	3.7.4	4.6.10.11	
(Long term)	3.7.5	4.6.10.12	
Instantaneous nonuniformity	3.7.6	4.6.10.13	
Longitudinal curvature	3.6.6	4.6.7	
Frictional vibration	3.6.11	4.6.9	
Sensitivity	3.7.1	4.6.10.8	
Wavelength response ^{1/}	3.7.2	4.6.10.9	
Electrical resistance	3.7.11	4.6.10.18	
Harmonic distortion	3.7.7	4.6.10.14	
Signal-to-noise ratio	3.7.8	4.6.10.15	

^{1/} Saturated output for WT155304, applicable requirement 3.7.3, applicable test 4.6.10.10.

4.4.1.1 Lot. For purposes of QCI, a lot is defined as all reels of one classification of tape produced in one facility under the same conditions using the same materials and offered for delivery at one time.

4.4.1.2 Quality conformance sampling procedure. A sample of tapes shall be randomly selected from each lot in accordance with table IX. If one or more defects are found, the lot shall be re-tested or re-examined for that characteristic which contributed to the failure. After corrective action and removal of defects, a new sample of parts shall be randomly selected in accordance with table IX. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

- a. For standard QPL level testing (see 1.2.5), the performance and acceptance of QCI is the responsibility of the manufacturer.
- b. For "T" level testing (see 1.2.5), the sample of tapes, selected by the manufacturer, shall be sent to the DoD Magnetic Media Laboratory located at the NAWC in Warminster, PA for performance and acceptance of quality conformance inspection (see 6.1.1).

TABLE IX. Quality conformance inspection sampling.

Lot size	Sample size
1 to 3	100 percent
4 to 25	3
26 to 50	5
51 to 90	6
91 to 150	7
151 to 280	10
281 to 500	11
501 to 1,200	15
1,201 to 3,200	18
3,201 to 10,000	22

4.4.1.3 Disposition of sample units. Sample units which have been subjected to the quality conformance inspection may be delivered on the contract or purchase order.

4.5 Test methods. The tape shall be visually examined to determine that the hub, reels, and tape are free from obvious defects specified in table X and conform to 3.8.

TABLE X. General defects.

Examination	Defect
Wind	Oxide surface not toward hub.
Wound pile envelope	Tape pile not smoothly wound; loose, visible folds, buckling, cinching, spoking, or gaps between the tape layers. Protruding tape edges, tape layers, or groups of layers. Plane of tape pile not perpendicular to hub axis. Tape packs against reel or flange.
Appearance	Tape surface not clean; presence of dirt, dust, lint, flakes, fuzz, or other foreign matter. Presence of blemishes, powder, holes, tears, creases, wrinkles or ragged edges, cracked coating, shredding of base material, raised areas, or scratches.
Construction	Tape does not unroll evenly and uniformly. Tape sticks to itself. Tape is affected by commonly used solvents or cleaners (isopropyl alcohol).

4.5.1 Wind. Tape shall be examined for defects specified in table X for conformance to 3.4.

4.5.2 Wound pile envelope. The tape shall be examined for defects as specified in table X to determine conformance to 3.6.7.

4.5.3 Anchorage. After completion of tests, a visual examination of the tape and recorder transport tape path shall be made for tape defects, as listed in table X, to determine conformance to 3.6.8.

4.5.4 Splices. The tape shall be examined to ensure continuous material, free of splices and in conformance to 3.6.9.

4.5.5 Length and width. The tape shall be measured to determine conformance to 3.5.

4.5.6 Radial distance. The radial distance value shall be measured to determine conformance with 3.5.1.

4.5.7 Slitting. The tape edges shall be examined with a microscope having a magnification of 100X to determine conformance to 3.6.10.

4.6 Tests. The tape shall be tested as specified in 4.6.1 through 4.6.10. The manufacturer has the option of using an alternate test method to those specified herein with the approval of the qualifying activity. However, in case of a dispute, the tests specified herein shall be used as the referee. In case of quality problems, a change in design, failure in QCI testing or any other quality related problems, the qualifying activity may require resumption of the referee tests specified herein.

4.6.1 Flammable material. The tape shall be ignited with a match flame and placed in a still carbon dioxide atmosphere to determine conformance to 3.3.1.

4.6.2 Fungus resistance. Resistance to fungus shall be determined in accordance with MIL-I-631, except that a 2 inch (50.8 mm) diameter roll of tape shall be tested. The entire sample shall be tested in the rolled condition. This test shall determine conformance to 3.3.2.

4.6.3 Yield strength. The tape yield strength shall be determined in accordance with ASTM D 638 and ASTM D 882. Three specimens of a particular type of tape shall be tested. A strip of tape not less than 7 inches (18 cm) in length shall be clamped in padded jaws with the initial distance between the jaws set at 4 inches (10 cm). The tape shall be clamped in the testing machine to have a minimum amount of slack and such that the full width of the tape at each padded jaw is in contact with the padded jaw. Care shall be taken to align the long axis of the tape with an imaginary line joining the points of attachment of the jaws to the machine. The jaws shall be tightened evenly and firmly to the degree necessary to prevent slippage. The rate of jaw separation shall be 2 inches (5 cm) per minute. The direction of pull shall be perpendicular to the lines of jaw/tape contact. The tape (assuming negligible thickness), the lines of jaw/tape contact, and the direction of pull shall all be co-planar. Each axis of the force-strain curve should be scaled. Two pounds (.909 kilogram (kg)) force per inch shall be used for the force axis and 1.0 percent elongation per inch shall be used for the strain axis. The approximate initial slope of the force-strain curve shall be determined by drawing a line from the point of the force-strain curve corresponding to one-half the specified yield strength (see table VI) and the origin. This line shall then be used to determine the 1.0 percent offset yield strength (in accordance with appendix X1 of ASTM D638) unless this line deviates (only for force values less than one-half the specified yield strength) from the force-strain curve by more than 0.1 percent elongation. If the deviation is greater than 0.1 percent elongation, on the specified portion of the graph, then a new line connecting the origin and the point on the force-strain curve corresponding to one-quarter the specified yield strength shall be drawn. This line shall then be used to determine the 1.0 percent offset yield strength (in accordance with appendix X1 of ASTM D 638) unless this line deviates (only for force values less than one-quarter the specified yield strength) from the force-strain curve by more than 0.1 percent elongation. If the deviation is greater than 0.1 percent elongation, on the specified portion of the graph, then the yield strength shall be approximated as stated in appendix X1 of ASTM D 638. The 1.0 percent offset yield strength and the force corresponding to 3.0 percent elongation shall equal or exceed the value listed in table VI for the particular type and size of tape being evaluated and shall be determined in accordance with appendix X1 of ASTM D 638. In the event that the

breakage of a particular tape occurs prior to reaching the 1.0 percent offset yield strength, or 3.0 percent elongation, the force at breakage shall equal or exceed the value listed in table VI. The yield strength testing should be performed with the Instron table model tester or its equivalent which shall provide the following features:

G-01-5	Tension cell
G-01-21	Gauge length and rapid return control
G-61-3C	Pneumatic action jaws
G-61-1C-10	Line contact jaw faces (one pair) 1.0 inch (25.4 mm) wide rubber covered
A-38	Lead cycling cams
A-96	Pip (marker) control

This criteria shall determine compliance with 3.6.1.

4.6.4 Shock strength. A pendulum-type slipperiness tester as specified in National Bureau of Standards RP1879 Volume 40, or equivalent, shall be used to conduct this test. The weight and position of the entire pendulum assembly shall be adjusted to provide 1.16 foot-pounds (for .500 inch (12.7 mm) width tape) of energy when striking the tape. The tape shall be held by clamps and guides so a free loop is positioned in the path of the cylindrical bob. The tape specimen shall be free of bends and kinks and shall be looped through the clamps with the oxide side inward and securely fastened. The pendulum arm shall be raised until it makes an angle with the vertical corresponding to a potential energy of 1.16 foot-pounds (for .500 inch (12.7 mm) width tape). The pendulum shall then be released smoothly, shall be allowed to strike the free loop of tape, break it, and swing past to indicate the residual energy of the pendulum. The difference between the initial and residual energy of the pendulum is the energy absorbed by the sample in breaking. The breaking point shall conform to 3.6.2.

4.6.5 Elongation under stress. Five samples from each roll of tape shall be cut 24 inches (61 cm) long. They shall be securely clamped and hung in the testing equipment for a period of 24 hours with no external weight applied. Before any weight is hung on the test samples, a reference mark shall be made approximately 20 inches (51 cm) from the point at which the tape is secured for the purpose of establishing a point of reference to measure the elongation and recovery of the sample. The distance between the reference mark and the point where the tape is secured shall be measured to an accuracy of .010 inch (.254 mm) with a 50-gram (1.75 ounce) weight applied. This measurement shall be taken as the base distance for calculation of residual elongation. After the establishment of the base distance with the 50-gram (1.75 ounce) weight, a 5-pound (2.25 kg) weight shall be applied to each sample at a zero time and allowed to hang undisturbed for 180 minutes ± 1.5 minutes, at which time the 5-pound (2.25 kg) weight shall be removed from the tape. The tape shall be allowed to hang under its own weight for an additional 180 minutes ± 1.5 minutes. The distance between the reference mark and the point where the tape is secured shall be measured to an accuracy of .010 inch (.254 mm) with a 50-gram weight applied and shall be taken as the final distance. The difference between the base distance and the final distance shall be expressed as a percent of base distance to determine conformance with 3.6.3.

4.6.6 Layer-to-layer adhesion. This test shall be conducted using an accurate means of wrapping a weighted 36 inch (91 cm) sample of tape of a one half inch (12.7 mm) mandrel of nonoxidizing metal, and a temperature-humidity chamber for conditioning the wound samples before examination. Five samples from each roll of tape shall be prepared 36 inches (91 cm) long. The tape shall be fastened at one end, oxide surface inward, to a mandrel. The mandrel shall be mounted in a motorized bearing holder so the tape may be freely wound about a central axis, and removed for conditioning. The free hanging end of tape sample shall be fitted with a 2,000 gram (71 ounce) weight, and a small strip of double-sided adhesive tape shall be placed on the oxide surface 1 inch (25.4 mm) above the weight. The mandrel shall be slowly and uniformly rotated so the tape, held in tension by the weight, winds uniformly around the mandrel into a compact and even roll. The double-sided adhesive tape, when wound into the test configuration, acts to secure the oxide surfaced tape and prevent

unwinding when the weight is removed. The wound samples on the mandrel shall be removed from the equipment and subjected to 130°F ±5°F (54.5°C ±2.8°C) and 85 percent ±5 percent RH for 16 hours; followed by 130°F ±5°F (54.5°C ±2.8°C) and 10 percent ±5 percent RH for 4 hours. The samples shall be uniformly conditioned by constant air circulation within the chamber. At the completion of the conditioning, the samples shall be removed from the chamber and permitted to stabilize in the testing area for a period of 24 hours. The end of the tape shall be carefully opened and the double-sided adhesive tape removed. The sample shall be observed to note if the first two or three wraps of tape loosen of their own accord. If loosening is not observed, the tape shall be carefully unwound by hand until 9 inches (23 cm) is exposed. At this point observe if the tape loosens of its own accord. If the tape still will not loosen, rotate the mandrel in the direction of unwinding for an arc of 90 degrees. If the tape adheres to itself and does not unwind, it shall be considered to have failed the layer-to-layer adhesion test. The tape shall be checked with a microscope with a minimum magnification of 100X for evidence of coating delamination and to determine conformance with 3.6.5.

4.6.7 Longitudinal curvature. This test shall be conducted on a flat smooth surface using a 48 inch (121 cm) straightedge and an optical measuring instrument. Three samples of tape shall be prepared by constraining a sufficient length of tape to lie flat in a horizontal plane under zero tension. The end corner edges of a 48 inch (121 cm) straightedge shall be brought in contact with the concave side of the tape, and the greatest distance between the straightedge and tape shall be in accordance with 3.6.6.

4.6.8 Modulus of flexibility. This test shall be conducted using a fixture that will secure the tape in a horizontal plane and allow measurement of the curvature of the extended free end in degrees. Three 6-in. long samples of tape shall be prepared. Three inches of tape, oxide surface down, shall be secured to the horizontal flat surface of the test fixture. The remaining 3 inches (7.6 cm) shall be allowed to extend free beyond the test fixture, to assume a natural curvature. The angle of curvature shall be measured from the square edge of the horizontal fixture, where the tape leaves the surface, to the free end of the tape, using a standard protractor. The minimum angle shall be as specified in table VI (see 3.6.4).

4.6.9 Frictional vibration. This test shall be conducted using a Honeywell Model 96 or Model 97 reference tape recorder-reproducer manufactured by Honeywell Test Instrument Division, Denver, CO 80217, or equal. Five rolls of tape shall be run at the various speeds in accordance with IRIG 106. No audible squeal, as the tape passes over the guides and heads of the recorder, shall indicate conformance with 3.6.11.

4.6.10 Magnetic. The magnetic test procedures shall be as specified in 4.6.10.1 through 4.6.10.22.

4.6.10.1 Test equipment. The test recorder-reproducer (see 4.6.9) shall be configured with record and reproduce heads that meet the requirements specified in IRIG 106. A Honeywell Model 96 or Model 97 reference tape recorder-reproducer manufactured by Honeywell Test Instrument Division, Denver, CO 80217, shall be used for this test. An equivalent recorder-reproducer system with correlatable performance as determined by the qualifying activity may be used.

4.6.10.2 Test setup. The test setup for the reference test recorder shall be as follows:

- a. The recorder shall be configured for either .500 inch (12.7 mm), or 1,000-inches (25.4 mm) tape usage, as applicable.
- b. The recorder shall be configured with either wide band heads or intermediate band heads as applicable.
- c. Direct record electronic cards shall be installed in the appropriate track slots, and direct reproduce electronic cards with the required equalizer filters (15/60/120 in/sec) shall be installed in the appropriate track slots.
- d. Install the wideband bias oscillator circuit card in the head driver housing.
- e. The reference test recorder shall be terminated with the proper load impedance.
- f. The reference test recorder shall be thoroughly cleaned, and the tape path and head assemblies demagnetized. The heads shall be adjusted for correct azimuthal orientation.
- g. The reference test recorder shall be set up and calibrated according to the manufacturer's recommended procedures, and the tape tension set for the tape size being tested (and as recommended by the recorder manufacturer.)
- h. All test signals shall be sine wave signals.
- i. Unless otherwise specified, measurements for this wideband tape shall be performed at 120 in/sec.

4.6.10.3 Centerline tape. An unrecorded roll of magnetic tape shall be furnished by the manufacturer for performance evaluation on the reference test recorder. The maximum allowable correction factor for this centerline tape, about the manufacturer's ideal product, shall be not greater than 1.0 dB. This centerline tape will become the reference tape for that manufacturer's tape and shall be used for establishing the calibration criteria for the reference recorder. The operating bias, standard record level, standard output level, and reproduce equalization shall be established using this reference tape. Tape submitted for qualification and quality conformance will be tested against this centerline or reference tape, and the reference test recorder calibrated using this centerline tape.

4.6.10.4 Secondary reference tape. The secondary reference tape shall be an unrecorded length of tape, the magnetic characteristics of which have been calibrated against those of the centerline tape. This secondary reference tape shall be used for preliminary adjustments of this reference test recorder, and as a working reference. A number of secondary reference tapes shall be generated for routine calibration.

4.6.10.5 Operating bias current. Operating bias current is that high frequency sinusoidal signal current through the recording head which will give a prescribed over-peak bias of the peak output signal at upper band edge frequency when recorded on a centerline or reference tape at standard record level. The over-peak bias shall be set to 1.0 dB at an upper band edge frequency of 2.0 MHz at 120 in/sec.

4.6.10.6 Standard record level. Standard record level is that level of an input signal, at some prescribed frequency, recorded on a centerline or reference tape with operating bias current. The record signal level current shall be adjusted such that, on playback of the recorded signal, the third harmonic exhibits 1 percent (minus 40 dB) distortion, as measured with a wave analyzer having a pass band of 1.0 kHz. The reproduce equalization electronics shall be adjusted as recommended by the reference recorder manufacturer. The signal frequency shall be 200 kHz recorded at 120 in/sec. Upon establishment of the standard record level criteria, the input signal amplitude shall be noted.

4.6.10.7 Standard output level. The standard output level is that reproduce signal level at some prescribed frequency, on a centerline or reference tape, at an input signal level of 6 dB below the standard record level with operating bias current. The record frequency shall be 200 kHz at 120 in/sec. Upon establishment of the standard output level criteria, the output signal amplitude shall be noted.

4.6.10.8 Sensitivity. The sensitivity of the tape shall be established by comparing the standard output level with the standard output level of a centerline or reference tape of the same type. With the reference recorder calibrated, and the standard output level established and noted using the centerline or reference tape, the tape to be tested shall have a signal recorded at the same frequency with operating bias current. The reference recorder shall not be recalibrated with the tape to be tested. A 200 kHz signal shall be used at 120 in/sec and at a record level 6 dB below standard record level. The played-back standard output level signals from the tape being tested shall not vary from the played-back standard output level signal of the centerline or reference tape by more than 0 dB \pm 2 dB. The first and last 100 feet of the roll of tape shall not be examined (see 3.7.1).

4.6.10.9 Wavelength response (WT155301, WT155302 and WT155303). The procedures specified in 4.6.10.8 shall be repeated at all the frequencies specified in 3.1 for the tape being tested. The measurements shall be made on a center track at any arbitrary location over the entire length of tape, excluding the first and last 100 feet (30 m) of the roll. A 0.6-mil wavelength at 120 in/sec shall be used for normalization. IRIG 118, Volume III, Appendix III-B shall be used for guidance (see 3.7.2).

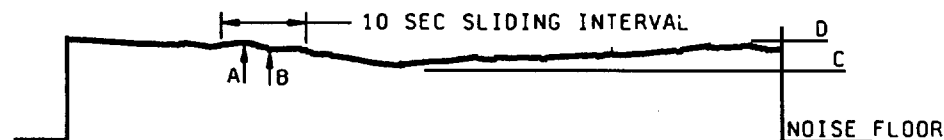
4.6.10.10 Saturated output (WT155304). This test measures the output level of a tape at a specified wavelength when recorded at saturation. This test shall be performed on a Honeywell-96 recorder with 25 mil heads. The input signal is applied directly to the pre-amp card for the test track. The record drive required to achieve saturation is determined by recording a 500 kHz sinusoidal wave at 15 ips. The output is monitored while the amplitude of the signal is slowly increased. The point where the increase in amplitude produces no further gain in output is called the optimum record drive and it is adjusted for each tape. Using the optimum record drive, a 500 kHz sinusoidal wave is recorded at 15 ips, 30 ips, 60 ips and 120 ips. The recordings are reproduced at 30 ips and the output at each recorded speed is measured. This corresponds to wavelengths of 30 μ m, 60 μ m, 120 μ m, and 240 μ m. Similar wavelengths are obtained by recording 4.0 MHz, 2.0 MHz, 1.0 MHz and 0.5 MHz sinusoidal waves at 120 ips. The output values are compared to those of a standard reference tape and the difference is reported as the saturated output for a given wavelength or frequency (see 3.7.3).

4.6.10.11 Output level uniformity (short-term). The short-term output level uniformity test of tape shall be made on a center track and on both absolute edge tracks. The tape to be tested shall be as received from the manufacturer, conditioned in accordance with 4.2.1. A prescribed signal shall be recorded at standard record level with operating bias current, and the reference recorder optimized for the tape being tested. The signal shall be recorded over the entire length of tape, excluding the first and last 100 feet (30 m). On playback the reproduce signal shall be 20 dB above the wideband noise floor of the reference recorder. The output signal shall be fullwave rectified and passed through a linear recording oscillograph or chart recorder with a response of at least direct current (dc) to 200 Hz. The oscillograph or chart recorder shall separate out the recorded signal and provide a graphical representation of any perturbation of the output signal. This graphical representation shall be examined over any 10 second interval. The maximum output signal variation (dB ratio)

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shall not exceed the values specified (see 3.1 and figure 2). A 1-MHz signal shall be recorded at 120 in/sec. This uniformity test may be performed simultaneously with output level uniformity long term and instantaneous nonuniformity (dropouts) tests specified in 4.6.10.12 and 4.6.10.13. Dropout defects shall not be included in this short term uniformity test (see 3.7.4).

4.6.10.12 Output level uniformity (long term). The long term output level uniformity test shall be similar to the short term uniformity test. The graphical representation shall be examined for variation in peak output over the entire tape length, excluding the first and last 100 feet (30 m) (see figure 2). The variations shall not exceed the values specified (see 3.1). The frequencies and record speed for this test shall be the same as those for the short term uniformity test. This uniformity test may be performed simultaneously with the output level uniformity short term, and the instantaneous nonuniformity (dropouts) tests (see 4.6.10.11 and 4.6.10.13). Dropout defects shall not be included in this long term uniformity test (see 3.7.5).



$$\text{UNIFORMITY (Short term)} = 20 \log_{10} \frac{A}{B}$$

$$\text{UNIFORMITY (Long term)} = 20 \log_{10} \frac{D}{C}$$

FIGURE 2. Uniformity.

4.6.10.13 Instantaneous nonuniformity (dropouts).

4.6.10.13.1 Instantaneous nonuniformity (dropouts for WT 155301). The instantaneous nonuniformity (dropouts) test shall be made on a center track and on both absolute edge tracks. The tape to be tested shall be as received from the manufacturer and conditioned in accordance with 4.2.1. A prescribed signal shall be recorded at standard record level with operating bias current, and the reference recorder optimized for the tape being tested. The signal shall be recorded over the entire length of tape, excluding the first and last 100 feet (30 m). A signal frequency of 1 MHz at 120 in/sec shall be recorded. On playback, the reproduce signal shall be at least 20 dB above the wideband noise floor of the reference recorder. The criterion for a dropout is a discontinuity in signal output such that the level of the reproduced signal has degraded in excess of 50 percent of the average reproduce signal for a period of 10 microseconds (μ s) or more. Each 10 μ s time period of signal degradation in excess of 50 percent constitutes one dropout count. This nonuniformity test may be performed simultaneously with the output level uniformity short term and long term tests as specified in 4.7.10.11 and 4.7.10.12 (see 3.7.6).

4.6.10.13.2 Instantaneous non-uniformity (dropouts for WT 155302 and WT 155303). The instantaneous non-uniformity (dropouts) test for 1 inch tape shall be made on every other track of the odd head stack of a 28 track, 25 mil track width head assembly, specifically track 1, 5, 9, 13, 17, 21, and 25. The instantaneous non-uniformity (dropouts) test for 1/2 inch tape shall be made on every other track of the odd head stack of a 14 track, 25 mil track width head assembly, specifically track 1, 3, 5, 7, 9, 11, and 13. The tape to be tested shall be as received from the manufacturer and conditioned in accordance with 4.2.1. A prescribed signal shall be recorded at standard record level with operating bias current, and the reference recorder optimized for the tape being tested. The signal shall be recorded over the entire length of tape, excluding the first and last 100 feet (30 m). A signal frequency of 1.025 MHz at 120 in/sec shall be recorded. On playback, the reproduce signal shall be at least 20 dB above the wideband noise floor of the reference recorder. The criterion for a dropout is a discontinuity in signal output such that the level of the reproduced signal has degraded in excess of 75 percent of the average reproduce signal for a period of 1 μ s or more. Each 1 μ s time period of signal degradation in excess of 75 percent constitutes one dropout count. This nonuniformity test may be performed simultaneously with the output level uniformity short term and long term tests as specified in 4.7.10.11 and 4.7.10.12 (see 3.7.6).

4.6.10.13.3 Instantaneous non-uniformity (dropouts for WT 155304). The instantaneous nonuniformity (dropouts) test shall be made on every track of the odd head stack of a 28 track, 25 mil track width head assembly, specifically track 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25 and 27. The tape to be tested shall be as received from the manufacturer and conditioned in accordance with 4.2.1. A prescribed signal shall be recorded at standard record level with operating bias current, and the reference recorder optimized for the tape being tested. The signal shall be recorded over the entire length of tape, excluding the first and last 100 feet (30 m). A signal frequency of 1.025 MHz at 120 in/sec shall be recorded. On playback, the reproduce signal shall be at least 20 dB above the wideband noise floor of the reference recorder. The criterion for a dropout is a discontinuity in signal output such that the level of the reproduced signal has degraded in excess of 75 percent of the average reproduce signal for a period of 1 μ s or more. Each 1 μ s time period of signal degradation in excess of 75 percent constitutes one dropout count. This nonuniformity test may be performed simultaneously with the output level uniformity short term and long term tests as specified in 4.7.10.11 and 4.7.10.12 (see 3.7.6).

4.6.10.14 Harmonic distortion. The third harmonic distortion of a recorded signal on tape at a prescribed frequency at standard record level and with operating bias current shall not exceed 2 percent distortion on playback. At 120 in/sec, the recorded frequency shall be 200 kHz. (see 3.7.7).

4.6.10.15 Signal-to-noise ratio. The centerline or reference tape shall be optimized to the reference recorder for the tape to be tested. Record a signal at a prescribed frequency using standard record level with operating bias current. The reproduced signal output level shall be noted, the tape externally erased in a bulk degausser, and the tape again recorded with the input signal terminal terminated in the proper input impedance. The reproduced signal output noise shall be noted. The instrument for these measurements shall have not more than a 3 dB attenuation at the reference recorder band edge frequency for the record speed specified, and an 18 dB per octave roll-off characteristic. The signal-to-noise ratio of this tape shall be the value in dB of the reproduced signal output minus the reproduced signal noise. The tape to be evaluated shall be tested in the same manner, except that no readjustment of the reference recorder shall be made. At 120 in/sec, the recorded frequency shall be 200 kHz. The difference between the signal-to-noise ratio of the centerline or reference tape and the tape being tested shall not exceed 4 dB (see 3.7.8).

4.6.10.16 Layer-to-layer signal transfer. The tape for evaluation shall be externally erased in a bulk degausser. A 1 kHz signal shall be recorded on the tape at 15 in/sec, at standard record level with operating bias. The output gain and equalization adjustments shall be properly adjusted for tape optimization. The record signal input level, with standard record level established, shall be measured and noted. The tape shall then be rewound and externally erased in a bulk degausser. The tape shall be placed in the record mode at 15 in/sec. Ten layers of tape shall be recorded and wound onto a reel with the input terminal in the proper input impedance. The 1 kHz input signal shall be restored and recorded with a 10 dB increase in the signal input level with operating bias current. One additional layer shall be recorded and wound onto the reel. The input signal shall be removed, the input terminal terminated, and 10 additional layers of tape recorded and wound onto the reel. The tape shall be rewound and placed in a chamber with a temperature of $150^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($65.5^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$) and 20 percent ± 5 percent RH for 4 hours. The tape shall be played back at 15 in/sec. The output signal levels shall be measured through a properly terminated 1 kHz filter with a passband of 10 hertz (Hz). The magnetic transfer effects of the single layer recording to adjacent portions of the tape shall be not less than the values specified (see 3.1 and 3.7.9).

4.6.10.17 Ease of erasure. The tape shall be externally erased in a bulk degausser. A signal of 1 kHz at 15 in/sec with operating bias current shall be recorded at standard record level. The reproduce gain and equalization shall be set for tape optimization. The input signal level shall be measured and noted. The input signal level shall be increased by 10 dB and this signal level recorded. The tape shall be rewound and placed in a chamber of $150^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($65.5^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$), 20 percent ± 5 percent RH for 4 hours. The tape shall be played back and the output measured through a properly terminated 1 kHz filter with a pass band of 10 Hz. W-T-1553/01 and W-T-1553/02 type tape shall be externally erased in a bulk degausser producing a 60 Hz alternating current (ac) field of 1,000 oersteds (peak value). W-T-1553/03 and W-T-1553/04 type tape shall be externally erased in a bulk degausser producing a 60 Hz ac field of 2,000 oersteds (peak value). The tape shall be played back and the output measured again through the filter network. The difference between the recorded signal level and the residual signal level shall be 60 dB minimum (see 3.7.10).

4.6.10.18 Electrical resistance. The surface electrical resistance of the conductive back coating shall be determined in accordance with ASTM D 257. The rolls of tape shall have been conditioned in accordance with 4.2.1 prior to this test. Three sample strips of tape shall be taken from rolls not subjected to the durability test and an additional three sample strips shall be taken from rolls subjected to the durability test (see 4.6.10.20). The test fixture and method of clamping shall be similar to figure 1 and figure 2 shown in ASTM D 257. The strips of tape shall be placed back to back with similar surfaces in contact with the fixture electrodes. The fixture and test strips shall be conditioned for 6 hours in a chamber set for $70^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($21^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$) and 25 percent ± 5 percent RH prior to testing. The potential for the back coating resistivity 100 V dc ± 10 V dc. Measurements shall be made between adjacent pairs of electrodes and the average value of electrical resistance for each sample strip shall not exceed the value for back coating as specified (see 3.1 and 3.7.11). Care should be exercised in the test fixture design and the cabling used because of the high potential voltage.

4.6.10.19 Abrasivity. For the tape being tested, a 50 kHz signal shall be recorded at 60 in/sec on a conditioned roll of tape (see 4.2.1). The center and edge tracks shall be used for signal recording. The reference recorder shall be fitted with an unworn set of reproduce heads used only for this test. The record signal shall be at standard record level with operating bias current and the tape optimized to the reference recorder. Tape tension shall be as recommended by the recorder manufacturer. The test signal shall be recorded the entire length of tape on the three tracks specified, and the output signal level measured through a properly terminated 50 kHz filter with a 50 Hz passband. The noise floor shall also be measured through this filter. The tape shall be completely recorded and placed on the take-up reel. The record head shall be removed and replaced with a dummy post, and the reproduce head surface carefully and firmly covered with 0.6 mil ± 0.1 mil 70/30 (copper/zinc) brass shim stock of knopp hardness of 200 percent ± 10 percent. The tape shall be played back over the shim stock at 60 in/sec and the first replay output signal and noise floor measured through the filter. The reduced output signal level caused by the presence of the shim stock shall be at least 20 dB above the noise and shall be within ± 3 dB of that output calculated by:

$$\text{Reduced output (dB)} = \frac{54.6 \times \text{shim thickness (mils)}}{\text{Recorded wavelength (mils)}}$$

The tape shall then be played in a bi-directional manner at 60 in/sec over the shim material until a minimum of 50,000 feet (15,000 m) of tape has passed over the stock. The reduced output signal shall be again measured through the filter and the output level increase due to shim stock wear shall be not greater than 2.5 dB from that measured on the first replay (see 3.7.12). The brass shim stock will be Government furnished material from the designated testing laboratory.

4.6.10.20 Durability. The rolls of tape used for the instantaneous nonuniformity (dropout) test (see 4.6.10.13) shall be used for this test. The tape shall be subjected to 100 wear passes on the reference recorder at the appropriate speed for the tape being tested. A wear pass shall consist of a normal play pass and a high-speed rewind pass over the tape heads for a 1,000 foot (300 m) length of tape. After completion of the last wear pass, the tape path and heads shall be cleaned and the instantaneous nonuniformity (dropout) test shall be conducted on that section of tape subjected to the durability test (see 4.6.10.13). The dropout count shall conform to 3.1. Should the final count after durability testing exceed the values specified in 3.1, the roll of tape may be processed through a tape cleaner winder and tested again. An arithmetic average of the first test, and two additional tests, shall be conducted to determine conformance with 3.1 (see 3.7.13).

4.6.10.21 Bi-directional performance. The tape to be tested shall be completely rewound so that the tape ends are reversed on a reel type similar to the originally supplied reel. Upon completion of the rewind process, the tape shall be subjected to the tests specified in 4.6.10.8, 4.6.10.9 (for WT 155301, WT 155302 and WT 155303), 4.6.10.10 (for WT 155304), 4.6.10.11 and 4.6.10.12 (see 3.7.14).

4.6.10.22 Environmental extremes. The tape to be tested shall be recorded as specified for output level uniformity. The tape shall then be placed in an environmental chamber and subjected to a temperature of 120°F $\pm 5^\circ\text{F}$ (49°C $\pm 2.8^\circ\text{C}$), and 85 percent ± 5 percent RH for a period of 8 hours. Upon removal from this environment, the tape shall be rewound at a tension recommended by the reference recorder manufacturer and allowed to stabilize in an environment of 75°F $\pm 5^\circ\text{F}$ (24°C $\pm 2.8^\circ\text{C}$) and 50 percent ± 5 percent RH for a period of 24 hours. The tape shall then be tested for output level uniformity in accordance with 4.6.10.11 and 4.6.10.12. Following this test, the tape shall be again placed in an environmental chamber and subjected to a temperature of 10°F $\pm 5^\circ\text{F}$ (-12°C $\pm 2.8^\circ\text{C}$), and 10 percent ± 5 percent RH for a period of 8 hours. Upon removal from this environment, the tape shall be rewound and allowed to stabilize in an environment of 75°F $\pm 5^\circ\text{F}$ (24°C $\pm 2.8^\circ\text{C}$), and 50 percent ± 5 percent RH for a period of 24 hours. The tape shall again be subjected to the tests specified in 4.6.10.11 and 4.6.10.12 (see 3.7.15).

4.7 Inspection of packaging. Sample packages and packs, and the inspection of the preservation-packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

5.1 Packaging. The requirements for packaging shall be in accordance with the contract or order (see 6.2), unless detailed requirements are specified in the contract.

6. INFORMATION FOR GUIDANCE ONLY

(This section contains information of a general or explanatory nature which is helpful, but is not mandatory.)

6.1 Intended use. The tape described in this specification is intended for use on wideband recorder-reproducers which have the capability of recording wavelengths as short as 0.06 mils (0.00006 in.). Frequency versus tape speed are shown in table XI.

TABLE XI. Wide band characteristics.

Maximum frequency (kHz)	Tape speed (in./sec)
31.25	1-7/8
62.5	3-3/4
125.0	7-1/2
250.0	15
500.0	30
1000.0	60
2000.0	120
4000.0	240

6.1.1 W-T-1553A and its corresponding part numbers have been superseded by this specification. Part number supersession data is reflected in table VI of W-T-1553/01.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- a. Title, number, and date of this specification.
- b. Basic indicator code (see 1.2.1).
- c. Width indicator code (see 1.2.2).
- d. Reel and hub indicator code (see 1.2.3).
- e. Length indicator code (see 1.2.4).
- f. Testing level indicator code (see 1.2.5).
- g. Wind, when other than continuous (see 3.4).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award or contract, qualified for inclusion in applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the supplier is called to this requirement, and manufacturers are urged to arrange to have the products they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Defense Supply Center, Columbus (DSCC-VQP), Post Office Box 3990, Columbus, OH 43216-5000, and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3.1). Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 Subcontracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.5 Subject term (key word) listing.

Instrumentation tape
Magnetic tape
Oxide-coated tape
Tape, recording

6.6 Testing level indicator code T. When testing level indicator code T is selected, QCI will be performed by the DoD Magnetic Media Laboratory, Naval Air Warfare Center, Aircraft Division, P.O. Box 5152, Code 5053, Warminster, Pennsylvania, 18974-0591.

6.7 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

MILITARY INTERESTS:

Custodians

Army - CR
Navy - EC
Air Force - 99

Review activities

Navy - AS, NV, OM
Air Force - 80

CIVIL COORDINATING ACTIVITY:

NASA - NPPO

Preparing Activity:
DLA-ES

(Project 5835-0111)